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WIPER ARM, WIPER BLADE, AND WIPER DEVICE, IN PARTICULAR FOR WINDSHIELDS OF MOTOR VEHICLES

Background Information

The invention relates to a wiper device, in particular for windshields of motor vehicles, according to the species indicated in the independent claim. Numerous wiper devices of this sort are already known. These have a wiper arm that is formed by a U-shaped profile part. Here the limb that, in the installed position, points in the direction of travel of the vehicle forms an integrated spoiler, and air outlet openings are situated on the additional limb and/or on the back. Such a wiper arm is, for example, indicated in FR 2 632 897.

However, the spoiler and the air outlet opening cannot prevent the occurrence, at higher vehicle travel speeds, of lifting forces that counteract the pressure force with which the wiper blade, fastened on the wiper arm, is pressed onto the windshield.

Advantages of the Invention

The wiper device according to the present invention having the features of the main claim has the advantage that through air guide elements that are situated in the interior of the profile part an advantageous course of the flow of the travel wind is produced, preferably along the width of the wiper arm, which on the one hand effectively increases the pressure force of the wiper arm at high speeds and at the same time eliminates disturbing wind noises, and on the other hand does not have an optically disturbing effect and does not significantly increase the cost of the wiper arm.

Advantageous developments and improvements of the features indicated in the main claim result from the measures stated in the subclaims.

If the air outlet openings are situated in the rear limb, facing away from the spoiler, of the U-shaped profile part, then these openings can be seen only from the interior of the vehicle, and can nonetheless be made sufficiently large to produce a sufficient downforce, and thus a sufficient pressure force.

If an air guide element protrudes beyond the limb of the U-shaped profile part, this is of particular advantage, because in this way sufficient air can enter into the wiper arm for the production of the downforce. This holds in particular if the air guide elements are situated in such a way that they form a funnel-type inlet in the area of the lower spoiler edge.

In addition, it is advantageous if the protruding air guide element has a soft rubber lip, in order to prevent damages or noises in case of a possible contact between the vehicle windshield and the air guide element. In this way, a particularly small spacing from the vehicle windshield can be achieved, thus achieving an even more advantageous course of the flow.

If the air guide elements are situated in such a way that the flow-through cross-section in the inflow area is smaller than it is in the outflow area, an optimal suction effect is achieved through the travel wind.

This effect can be further strengthened if, in the installed position, the air guide elements are closer to the windshield in the inflow area than in the outflow area.

An optimal course of the flow is achieved if the air guide

elements are situated in such a way that the air flowing through is accelerated, so that a slight suction effect arises in the direction of the windshield. This airfoil-type effect increases the wiping result significantly, particularly at high speeds.

In addition, it is advantageous to situate at least one air outlet opening in the center limb of the U-shaped profile part, because in this way the flow cross-section in the outflow area can be further increased.

If an air outlet opening is situated in the limb facing away from the spoiler, and another one is situated in the center limb, then almost any course of the flow can be achieved inside the U-shaped profile, and thus inside the wiper arm.

If, in addition, the air guide elements are fashioned as an injection-molded part, they can be manufactured economically, and they increase the weight of the wiper device only marginally. In addition, these injection-molded parts can also be replaced easily in case of destruction.

It is particularly advantageous if the air guide elements are clipped into the profile part, in order to enable completion of a rapid installation and rapid exchange, if for example damage has occurred.

In addition, it is advantageous to glue the air guide element into the profile part, in order to obtain a positively locking, smooth connection, and in this way to avoid the development of disturbing noise.

It is particularly advantageous if the air guide element has a projection for the guiding of the wiper blade, through which the relative position of the wiper blade to the air guide element is always maintained as well as possible.

It is particularly advantageous if the wiper blade is fashioned as a flat-beamed wiper blade. The overall constructive height between the wiper arm, the spoiler and the wiper blade is reduced to a minimum in this way, because no expensive clip construction that is disadvantageous to the air flow is required between wiper blade and profile part.

In addition, it is advantageous if a funnel-type or double-funnel-type channel arises between the air guide elements, in order to achieve an optimal course of the flow. In the case of a double-funnel-type channel, the air inlet openings and the air outlet openings are larger than the center of the channel.

The wiper arm according to the present invention according to claim 14 has the advantage that through the situation of an air guide element in the interior of the U-shaped profile part, an advantageous course of the flow is achieved, in particular at high flow speeds.

It is thereby to be regarded as advantageous if at least one air guide element is borne by the wiper blade itself, and is fastened thereto. In this way, the flow strikes the wiper blade itself and produces an additional pressure force that presses the wiper blade onto the windshield.

It is particularly advantageous if the profile part has an air flow opening in the area of its front limb, in which an air guide element borne by the wiper blade is received. In this way, the spoiler of the wiper blade/wiper arm combination is formed equally by the wiper blade and by the wiper arm, resulting in a more uniform distribution of pressure force.

This is particularly advantageous if the air guide elements borne by the wiper blade terminate approximately flush with the front limb, so that an essentially flat spoiler surface results.

In order to increase stability, in particular against torsional flexing, it is in addition advantageous to provide a plurality of air flow openings along the longitudinal extension of the wiper arm. In this way, webs arise between the air flow openings, which improve the rigidity of the wiper arm.

It is particularly advantageous to provide nozzles in the interior of the profile part for the exit of cleaning fluid. Larger, e.g. heatable, nozzles can be arranged in particular in the area of the rear limb, in which the nozzles disturb only slightly the flow of air through the air guide elements positioned in front of them.

A wiper blade according to the present invention having the features of claim 20 has the advantage that, due to the fact that the back of the blade bears at least one air guide element that works together with an upper air guide element situated on or in the wiper blade, optimal air flow characteristics can be achieved. In particular, due to the direct air flow on the wiper blade, not only is this blade pressed against the windshield indirectly via the wiper arm, but also the wiper blade itself is so pressed.

In this context, it is particularly advantageous if the lower air guide element, borne by the back of the blade, is able to pass through the profile part of the wiper arm, in particular through its front limb. In this way, it is possible to achieve a flat spoiler upper surface on the front limb of the profile part, and nonetheless to have air flow immediately against the wiper blade.

Here it is particularly advantageous if the wiper blade bears a plurality of air guide elements along a longitudinal extension, since in this way the stability of the wiper arm is not limited.

Drawings

Exemplary embodiments of the invention are shown in the drawings, and are explained in more detail in the following specification.

Figure 1 shows a wiper device according to the present invention in a perspective view,
Figure 2 shows a wiper arm of a wiper device according to the present invention in a perspective view,
Figures 3 to 8 show sections through wiper arms of a wiper device according to the present invention in different variations,
Figure 9 shows a wiper blade having air guide elements in a perspective view,
Figure 10 shows a detail of the air guide element from Figure 9,
Figures 11 to 16 show sections through a wiper arm with wiper blade,
Figure 17 shows an inventive wiper arm having a wiper blade, in a perspective view,
Figure 18 shows wiper arm and wiper blade according to Figure 17 after assembly,
Figures 19 to 21 show cross-sections through a wiper arm with wiper blade according to Figure 18, and
Figures 22 to 25 show cross-sections through a wiper arm with wiper blade according to Figure 18, but with nozzles and various channels.

Description of the Exemplary Embodiments

Figure 1 shows a wiper device 10 in a perspective view. This device has a motor 12 that drives, via a rod 14, two wiper arms 16, each bearing at its end a wiper blade 18. Wiper blade 18 is fastened on wiper arm 16, approximately parallel to the longitudinal extension thereof, and is partially surrounded by wiper arm 16. Of course, it is also possible for wiper blade

18 to be surrounded completely by wiper arm 16. Here, wiper blade 18 is fashioned as a flat-beamed wiper blade.

As a part of a motor vehicle, wiper device 10 is fastened to the body thereof, and causes wiper blades 18 to slide over windshield 20. During travel operation of the motor vehicle, the travel wind causes a flow of air, indicated by flow arrows 22.

Figure 2 shows a wiper arm 16 of a wiper device 10 according to the present invention, in a perspective view. The air flow direction is here again represented by flow arrow 22. Wiper arm 16 is essentially made up of a U-shaped profile part 26 that is chamfered on the side facing the flow of air to form a spoiler. At the ends of its longitudinal extension, fastening elements 24, in particular hooks and/or eyes, are arranged for fastening to rod 14 and to wiper blade 18. On the side facing away from the flow of air, air outlet openings 40 are situated that are separated from one another by webs 25. In an inner area 34 of profile part 26, air guide elements 36, 38 are clipped in as a one-piece injection-molded part, which is represented in the drawings by broken lines. This injection-molded part is shown more precisely in cross-section in Figures 3 to 8.

Along its longitudinal extension, side walls 29 are situated between upper and lower air guide element 36, 38; these walls continue individual air outlet openings 40 of profile part 26 in the interior of air guide elements 36, 38. On the side facing the flow, these side walls 29 are brought together in pair-by-pair fashion, and prevent flow turbulences at webs 25 situated between air outlet openings 40. In addition, they increase the stability of the injection-molded part.

Figure 3 shows a cross-section through the wiper arm of Figure 2. Profile part 26 of wiper arm 16 has a back 30, from which the two limbs extend laterally. The limb facing the flow of

air is designated in the following as front limb 28, and the limb facing away from the flow of air is designated rear limb 32. Here as well, the flow of air is indicated by flow arrow 22.

In the interior area 34 of U-shaped profile part 26, air guide elements 36, 38 are situated, which partially also extend beyond inner area 34 of profile part 26. Underneath profile part 26 a wiper blade 18 is shown, fashioned as a flat-beamed wiper blade. Air from inner area 34 of profile part 26 can flow out through air outlet openings 40, situated in its limb 32 facing away from the flow.

In this context, upper air guide element 36 is situated in such a way that it extends from the lower edge of front limb 28, facing windshield 20, to the upper edge of air outlet opening 40. Lower air guide element 38 projects from the lower edge of air outlet opening 40, over wiper blade 18 and beyond profile part 26, in the manner of an airfoil, so that a funnel-type air inlet opening 42 arises. In this way a nozzle effect arises between air inlet opening 42 and air outlet opening 40, which strengthens the pressure force with which wiper arm 16 presses wiper blade 18 onto windshield 20. At their end, air guide elements 36, 38 adjoin the air outlet openings in flush fashion, so that as little turbulence is formed in this area as possible.

As shown in Figure 4, air guide elements 36, 38 can also be fashioned such that they form a smooth, rounded-off transition with additional limbs 30, 32 in the area of the edges of air outlet opening 40.

Front limb 28, which forms the spoiler, can be shaped in convex fashion or, as shown here, in concave fashion.

Figure 5 shows how lower air guide element 38 has a flow element 44 that extends from the lower side of lower air guide

element 38 to the lower edge of rear limb 32, in order to avoid disadvantageous flow characteristics such as turbulences in this area, without having an adverse effect on the flow to air outlet opening 40. Of course, lower air guide element 38 can also be fashioned at its rear side in such a way that no hollow space arises between flow element 44 and air outlet opening 40.

In Figure 6, lower air guide element 38 is lengthened at its side facing the flow by a soft rubber lip 46. Here this rubber lip 46 is injection-molded onto the lower air guide element over a projection 48, e.g. in a multicomponent injection-molding method. Here rubber lip 46 is oriented approximately perpendicular to windshield 20 and approximately parallel to the midaxis of wiper blade 18, but it can also have a knee 52, and its cross-section can taper downwards.

Figure 7a shows a variation of a wiper arm according to the present invention. Here U-shaped profile part 26 has, on its side facing the flow, a concave curvature, the lower edge of front limb 28 lying more closely on windshield 20 than the end, facing the flow, of lower air guide element 38 and the lower edge of rear limb 32. Here, air outlet opening 40 is situated in back 30, and the two air guide elements 36, 38 are correspondingly guided in the direction of back 30.

In addition, in Figure 7a a parallelogram of forces is shown as it arises through interior air guide elements (36, 38). Due to the acceleration, air that flows through air guide elements (36, 38), which are fashioned as funnel-type channels, exerts a normal force (FN) perpendicular to the surface of lower air guide element (38). This is decomposed into a pressure force (FD) that presses wiper blade (18) in the direction of windshield (20), and a horizontal force (FH) that pushes wiper blade (18) over windshield (20).

As shown in Figure 7b, lower air guide element 38 in inner

area 34 of profile part 26 can be situated such that wiper blade 18 is partially covered in terms of flow, so that only a small amount of air flows through area 54 over wiper blade 18.

In Figure 8a, a variation of the exemplary embodiment from Figure 7a is shown. Besides air outlet opening 40 in back 30, an additional air outlet opening 40 is situated in rear limb 32. In order to prevent eddies between upper and lower air guide element 36, 38 in the area of air outlet openings 40, a center wedge 56 is situated between these, ensuring a laminar course of the flow in the direction of the two air outlet openings 40. This center wedge 56 is fashioned as an approximately triangular wedge, whose foot extends from the upper edge of rear air outlet opening 40 up to the rear edge of upper air outlet opening 40 situated in back 30, and terminates flush with these edges.

Figure 8b shows a further variation. As in Figure 8a, wiper arm 16 has two air outlet openings 40, but, as is also the case in Figure 3, lower air guide element 38 protrudes beyond the edge of front limb 28, so that wiper blade 18 is covered almost completely by lower air guide element 38, and forms a funnel-type air inlet opening 42.

Figure 9 shows a wiper blade 18 according to the present invention in a perspective view. Here lower air guide elements 38 are fastened not to wiper arm 16, but rather to wiper blade 18.

As already shown in Figure 8b, wiper blade 18 is essentially made up of a wiper blade element 58 whose blade back 60 is reinforced by a spring strip 62. Lower air guide elements 38 are fastened, e.g. clipped on, to spring strip 62. These guide elements can in principle also be fastened to wiper blade element 58 in the region of blade back 60, or can be formed in one piece from wiper blade element 58 in the extruder. Moreover, spring strip 62 can conceivably be omitted. This can

for example be achieved through a corresponding rubber mixture in the area of blade back 60 of wiper blade element 58.

In Figure 10, lower air guide element 38 can be seen as it is clipped on to spring strip 62. This air guide element 38 is made up of a plate, on which wedge-shaped projections 64 that come to a point against the direction of flow are situated. Sidewalls 29 of wedge-shaped projections 64 are formed in such a way that an optimal course of the flow of the entering air is achieved in the direction of air outlet openings 40 of wiper arm 60.

Figure 11 shows a cross-section through such an air guide element 38 having a wiper arm 16. Air guide element 38 is clipped on to spring strip 62 in the region of blade back 60 of wiper blade element 58 by clip elements 62. Of course, air guide element 38 can also be fastened to blade back 60 by gluing, locking, or ultrasound imprinting. The section shown here is situated in the area of air outlet opening 40, as shown in Figure 10.

On the edge of air outlet opening 40 facing the wiper blade, air guide element 38 has a deflecting edge 66 in order to improve the course of the flow. Through this, the deflection of the flow of the travel wind takes place at wiper blade 18, and not at wiper arm 16, so that a lifting off of wiper blade 18 is avoided.

In Figure 12, the same cross-section is shown as in Figure 11, but in an area in which wiper arm 18 has no air outlet opening 40. Air guide element 38 here extends up to back 30, and divides the air stream through sidewalls 29 into two parts, so that the flow can escape through air outlet openings 40.

Figure 13 shows a variation of the system from Figure 11. Air outlet opening 40 is located in the area of back 30 of wiper arm 16, and lower air guide element 38 is shaped in such a way

that the air stream of the travel wind is deflected in the direction of air outlet opening 40 in back 30.

Corresponding thereto, in Figure 14 the area of the wiper arm without air outlet opening 40 is shown. Here, air guide element 38 is essentially box-shaped, and seals the interior of wiper arm 16.

Figure 15 shows a development of the system shown in Figure 11. In addition to lower air guide element 38, fastened to wiper blade 18, here an upper air guide element 36 is fastened in wiper arm 16. This can for example be realized through a clip connection. In this way, the air stream is deflected in the direction of air outlet opening 40 in a better manner, lower in turbulence.

In Figure 16, wiper arm 16, having upper air guide element 36, is shown for the area in which no air outlet opening 40 is provided. Upper air guide element 38 is displaced upward, in the direction of wiper blade 18, and almost touches the upper edge of lower air guide element 36, which is raised at this point, and divides the flow towards the sides.

Figure 17 shows a further variation of inventive wiper arm 16, having a wiper blade 18, in a perspective view.

Wiper arm 16 is essentially made up of an essentially U-shaped profile part 26, to which wiper blade 18 can be coupled. Wiper blade 18 has, in the area of its blade back 60, air guide elements 38 that are fashioned such that they penetrate into the interior of profile part 26 when wiper arm 16 is connected with wiper blade 18. In order to increase the pressure force with which wiper blade 18 is pressed onto windshield 20, front limb 28 of profile part 26 has air flow openings 70, into which air guide elements 38 of wiper blade 18 penetrate in the assembled position, and forms an essentially smooth surface with front limb 28. This is shown in Figure 18.

In this context, the height of lower air guide elements 38 fastened to wiper blade 18 is determined by the geometry of wiper arm 16. Typically, the interior height H in the area of the end of wiper blade 18, covered by wiper arm 16, is greater than the exterior height h in the area of the fastening of wiper blade 18 to wiper arm 16, or even edge height h' at the end, facing away from wiper arm 16, of wiper blade 18.

Figure 19 shows a section through wiper arm 16 having air guide element 38 from Figure 18. Wiper arm 16 has air flow opening 70 in the area of its front limb 28. Air guide element 38, fastened in the area of blade back 60, enters into this air flow opening 70, so that an essentially smooth surface results.

For this purpose, lower air guide element 38 essentially has an inverted V shape. On its side facing the flow, air guide element 38 has a knee 72 to which a stilt 74 is connected. Clip element 68, which connects air guide element 38 with spring strip 62 of blade back 60, is then situated on this stilt. Through stilt 74, there results a smooth curve between front limb 28 and the air flow surface of air guide element 38.

Wiper blade 18 can be moved in the vertical direction inside profile part 26 of wiper arm 16 in order to compensate different geometries of windshield 20. In order to enable this lifting movement, air flow opening 70 of wiper arm 16 extends beyond back 30 of profile part 26. This is again shown in Figure 20.

Figures 21a and 21b show a variation of the present invention. Wiper arm 16 can also be of flat construction in the areas of stability, between air flow openings 70, and in cross-section can extend approximately parallel, or with only a slight convex curvature, to blade back 60 (Figure 21b). In this embodiment, air guide elements 38 then protrude from wiper arm

16 along the longitudinal extension of wiper arm 16, in comb-type or tooth-type fashion (Figure 21a).

In Figure 21, the area of wiper arm 16 is shown in which no air flow opening 70 is provided. In this area, air guide element 38 is fashioned only in degenerate form, i.e. only as a plate that is situated approximately parallel to spring strip 60 and that functions only to aid the stability of the system.

In this area, there results a hollow space 76 inside the wiper arm that is suitable for the situation of nozzles 78 through which cleaning fluid can be sprayed onto windshield 20. This is shown in Figure 22.

Here, as indicated in Figure 22, nozzles 78 can either spray directly out of wiper arm 16, or, as shown in Figure 23, can spray onto windshield 20 through a spray opening 80. In the areas in which air guide element 38 passes through air flow opening 70, this guide element can also be fashioned, by an additional knee 82, in such a way that a cleaning fluid channel 84 can be situated here as well. A flow supply line for a nozzle 78, a cleaning fluid channel heating unit, or a nozzle 78 itself, can be arranged here, as shown in Figures 24 and 25. In particular, nozzles 78 having non-return valve, that have a large constructive shape.

Abstract

A wiper device is proposed having a wiper arm (16) that is mounted in driveable fashion and that bears a wiper blade (18), the wiper arm (16) being formed by an essentially U-shaped profile part that surrounds the wiper blade (18) at least partially. The front limb (28), which in the installed position points essentially in the direction of travel of the vehicle, forms a spoiler, and at least one air outlet opening (40) is situated on the additional limbs (30, 32). An air guide element (36, 38), which can also pass through the profile part, is situated at least in the inner area (34) of the U-shaped profile part.